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ABSTRACT

This paper looks at the potential of the new electronic media of broadcast television (including teletext and interactive cable), the videodisc, and the microcomputer. It examines the nature and extent of these media as textual communication systems and considers their implications in terms of both the reading skills they demand, and the ways in which these skills may be acquired or facilitated. In particular, it focuses on how the video screen might be used graphically to assist its future users, and ways in which educators and others interested in the process of reading verbal materials may contribute to the development of both the text presented and the software designed to teach reading skills. The paper may interest not only teachers of these skills but also broadcasters, electronics hardware manufacturers, computer software producers, and others with interests in the development of literacy. A 40-item reference list is included. (THC)

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READING AND THE VIDEO SCREEN

M.E.R.: No. 2

Brent Robinson

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Editorial Note

This publication is the second in a series of working papers on issues surrounding the study and use of media in education. This particular paper looks at the potential of the new electronic media of broadcast television (including teletext and interactive cable) of the video disc and of the micro-computer. It examines the nature and extent of these media as textual communication systems and considers their implications, in terms of both the reading skills they demand and the ways in which these skills may be acquired or facilitated.

The paper should be of interest not only to the teachers of these skills but also to broadcasters, electronics hardware manufacturers, computer software producers and any others with an interest in the development of literacy.

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Author's Note

The use of the masculine pronoun should be taken to mean 'she' or 'he'.

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A threat to literacy or a challenge for the literate?

The hypothesis that our literary tradition is being replaced by an essentially visual mass culture is a subject which has received considerable attention in recent years. Few may go as far as Marshall McLuhan who claims that literacy has now outlived its usefulness, but many would agree with that writer's observation that we are now faced with a "new electric technology that threatens this ancient technology of literacy" (1). Often forgotten by such critics, however, are the ways in which the new media can and may be seen to be making a contribution to the achievement of literacy rather than its decline. Some observers, for example, have drawn attention to the motivating power which television can wield to interest viewers in print, and a number of educational television series like 'A Good Read' and 'Inside Pages' are specifically geared to promoting particular books. Meanwhile, other popular peak viewing programmes often push the books from which they derive (or which they generate) to the top of the publishers' lists. When one looks at television as a literate and verbal medium *per se*, however, there is less documentation. Programmes which contain explicitly didactic material on reading skills are a relatively late development in educational broadcasting. In addition direct reading of text from the screen has not received great attention, despite recent technological advance whereby electronic devices now rival the printed page as purveyors of information. And yet the new media – videodisc, teletext, viewdata, microcomputer – all make heavy use of verbally encoded material. In the classroom, in the home and in the place of employment the population will be faced increasingly with information retrieval and general communications systems which, far from diminishing the need for literacy, re-assert the primacy of the written word in the communication process.

ITV's Oracle and BBC's Ceefax teletext services already offer many hundred pages of text between them (2) and if more frequencies become available – as with the projected closure of the 405 line service and the introduction of cable networking – it is suggested that these might open the possibility for 'dedicated' teletext channels which could carry over 50,000 pages (3). British Telecom's Prestel similarly offers vast resources of electronic reading material. At the moment over 30,000 pages of text are available but there is ". . . virtually no limit to the number of 'pages' of information available to the user" (4). Finally, the videodisc, which has at last been launched in Britain, is capable of containing 46,000 pages of electronic text on each disc.

In this electronic age, then, perhaps even our current theories and definitions of verbal literacy (and of the reading process in particular) need to be re-assessed. The overall concept of reading as a process for the acquisition of meaning may not have altered but in order to achieve that meaning the reader must now undergo new reading experiences. At the levels of perception and decoding, the new literacy is no longer concerned simply with black symbols on white pages. Today, a definition of literacy which includes "the ability to deal knowledgeably with all the communication media" (5) takes on enlarged meaning, for text is presented not only on the page but on the screen too. Our new definition of literacy must also include all the other higher information access and reading skills formerly associated only with printed material but now of vital importance to the users of the sophisticated and complex retrieval systems belonging to the new electronic means of data storage.

If anything, the new media necessitate a newly enlarged – if not more exacting – degree of literacy. Beginning in the classroom and extending into many spheres of adult life, the increasing intrusion of the new media demands that the teacher equips his pupils with the skills to use them efficiently and with optimum gain and satisfaction.

This paper, therefore, takes a narrow brief. It is not concerned with how television and the new media encourage and develop literacy in general terms. It does not discuss the many techniques which have been used so expertly over the last two decades to motivate, teach and enhance the reading process. It certainly does not include any semiological concept of 'reading' the screen. Reading here is taken to mean the decoding of messages from verbal signs and symbols and this paper concentrates specifically on the video screen as the new medium for the display of verbal text. It considers the demands of the medium upon its viewing readers and the ways in which that same screen may be utilised to engender and foster the reading skills it demands. In particular, it focusses on how the video screen might be used graphically to assist its future users and in what ways educationalists and others interested in the process of reading verbal material may contribute further to the development of both the text presented and to software designed to teach the reading skills – both those which are general and those specific to the medium.

Reading the screen – the story so far

It would be simplistic to claim that the demands of the new media are necessarily novel. America, probably more than any other country, has already experienced the consequences of the first significant electronic medium, television, and Peters (6) draws attention to the extent to which that country's viewers are already having to cope with printed messages on their screens. His discussion centres on the print in commercials and in U.S. news and sports broadcasts, yet he reports that viewers still encounter some 1000 printed words per evening in prime-time commercials in addition to 1500–2000 printed words per week if they watch two half-hour news broadcasts daily. Such is the amount of print already on television that Cooney (7) claims that many U.S. parents now believe that the medium has taught their children to recognise words and phrases before they are taught to read them formally. Peters (8) similarly reports a number of experiments with pre-school children which conclude that a significant proportion of those children who learn to read before they enter school do so because of televised print.

On reflection, perhaps this is not surprising since many of the techniques used in overt reading programmes (outlined later in this paper) can be seen working in normal scheduled programming and advertisements. All television, after all, is an exercise in visual and aural perception and the development of these is an essential pre-requisite for reading readiness. By way of example, Downes (9) states that the main visual perceptual skills for reading include:

- the ability to distinguish foreground from background
- the ability to notice differences in shape and size of image
- the ability to perceive 'spatial arrangement'
- the ability to perceive that objects are 'constant' despite variations in two-dimensional representation due to differences in perspective.

Television, by its very nature, exercises and develops such skills. Advanced production techniques, such as those already finding their way into many different types of programme format, must lead to greater perceptual alacrity and more sophisticated visual discrimination. This, in turn, should lead to greater reading readiness.

The task of reading itself is formidable and requires a highly refined organisation of perception of shape and spatial arrangement, but a few examples will show how television may again be of benefit. The presentation of shorter messages on the screen in the course of normal programming can aid the perfection of word attack skills and develop sight vocabulary. The fact that words are often captioned or superimposed over their referrents (particularly in advertisements) is likely to develop semantic awareness, and if accompanied by a voice may enhance phonic development. Constant repetition of the word (again in advertisements especially) aids this development and allows the reader to self-correct, while accompaniment of longer texts by a voice (as in subtitled news broadcasts or public announcements) should develop greater reading ability generally and encourage fluency.

Further research on the reader and print in broadcast television was conducted by Adams and Harrison (10). They gathered a total of 5499 different words read from the screen during seventy five hours of viewing. Half of the total number of words was analysed and it was found to consist of more than 50% of the Thorndike Remedial Reading Vocabulary. The rest of the words comprised proper nouns used in advertising, specialised vocabulary, common or general vocabulary, words over three syllables in length and numbers and abbreviations. Of course, these facts may be considered an indictment of the standard of text on the screen for adult viewers but it did mean that at least half of the elementary school students utilised by Adams and Harrison were able to cope with the text they saw. Only 10% to 15% ignored the text and the rest thought it actually proved helpful in developing their reading skills; 80% of the low reading groups thought silent reading was helped significantly; 64% of the middle reading groups considered spelling was improved and 76% of the high reading groups thought the display of text on television enhanced their vocabulary.

Broadcast television in particular, then, is still incidentally a reader's medium. It does make demands upon the viewing reader and also in turn develops his ability to read through its own special techniques and characteristics. As Peters says:

> The home television set does not have to be an adversary. It is, right now, a tool that is used by the reader to build reading skill. (11)

Adams and Harrison (12) suggest that teachers should extend these possibilities and develop activities to stress the printed words on the screen. Their useful ideas begin with simple letter differentiation: "Copy 10 words you read from television. Circle all of the consonant clusters"; or again: "Study and take notes on the different sizes of print used in the advertisements. Discuss the uses in class." They move through higher reading skills: meaning ("As you watch the advertisements, select four words that could be used differently due to multiple meanings"), and context ("List five phrases you read on the television. Discuss the literal versus the contextual meaning"). Finally they reach the higher reading skills with inferential and evaluative comprehension.

The screen as teaching medium

But if television is already a tool that can be used by the reader to build the sub-skills in the reading process how might this be developed further by specific software rather than by teachers' utilisation of what is currently available? Gattegno summarises the means at our disposal thus:

> All we have at our disposal is: a screen in which electrons can be commanded to organise themselves according to our wishes for as long as we wish; color on color tubes; various hues of grey on the older black and white tubes; a sound system to convey the sounds we select for as long as we wish. (13)

Given these facilities, Gattegno goes on to claim that the medium is so effective that reading may be taught via the video screen alone:

> Since the image on the screen can be acted upon by will and made to follow the instructions of a programer (sic) and since the sound part of the set can also be used at will, we may find that teaching reading is more effectively done on television than anywhere else for all but a very small minority of children. (14)

Gattegno then proposes and expounds a complete screen initial reading programme consisting of a number of short video sequences. But even if one does not concur fully with Gattegno there would seem to be certain opportunities afforded by this medium to the beginning reading teacher.

Training the pre-reader

As already mentioned, all television would seem to have the capacity for enhancing the visual perception and discrimination without which reading could not commence. Shape recognition in particular is something which the video screen can probably handle more easily than the teacher in the classroom. An incomplete shape or picture may be presented and the viewer asked to select visually the missing part from a number of parts available on the screen. In another instance, as described by Sherrington (15) or Chazan and Downes (16) and used for example in the programme **Sesame Street**, a viewer may be asked to distinguish and pair similar shapes. Animation and a variety of angles may alter the perspective so increasing perceptual alacrity and thus anticipating some of the problems which are encountered when learning to read – reversals, mirror images and misplacements of letters. Such exercises can be made progressively more difficult as letters are introduced (d/p/b or v/w for example). In addition words with similar outlines can be presented (for example: feed/tool/lock). Such shapes can be made to appear and to disappear and to move about the screen to demonstrate similarities.

The pre-reader also needs to be trained in left to right sequencing. Whenever animation techniques are used, symbols and pictures should always appear from left to right. In addition, Sherrington (17) suggests simple animated sequences where the viewer is encouraged to follow the progression of the object – like a train or ball – across the screen. Later, games and puzzles involving left to right orientation might be useful. Later still, when spellings are introduced, each section of the picture can be shown with a letter so that the picture and the word are built up from left to right. As Roser noted (18) the video screen lends itself well to the pop up left to right sequencing so effectively used in such reading programmes as **The Electric Company**.

Later again, sentences might be built up in the same way (i.e. from left to right) and certainly for the beginning reader, all captions should appear visibly, a letter or word at a time, rather in the way that the print appears from an electric typewriter. This is preferable to the sudden appearance of a whole caption though it must be stressed that at higher reading levels the eyes do not move smoothly at an even rate from left to right and one does not want to enforce this type of eye movement on the more fluent reader. At that level, it is better to reveal the whole caption at once and allow the viewer's eyes to make their own saccadic movements over the text, the reader

determining his own fixations and eye-spans. Sometimes, early readers experience difficulty in following written symbols from the end of one line to the beginning of the next and practice can be given in various ways developing from the techniques above – building up pictures in rows from left to right across the screen, for example, before moving on to similar practice with words.

Teaching the beginning reader

There is a natural progression between pre-reading skills of shape identification and later letter identification and here again animation and captioning can make exercises in letter recognition visually exciting and stimulating. A jumbled group of letters might be shown and the viewer asked to pick out all the identical shapes he can find. Pictures of objects or actions might be shown together with a letter and the viewer asked to say whether it is the correct initial letter of the object's name. Attention can be drawn to difficult spelling features using colour and animation while rapid recognition of letter and word shapes can be encouraged by using the video screen to replicate electronically the mechanism of the tachistoscope which systematically reduces the time permitted for perception and recognition of letters, words or sentences.

Probably the majority of recent reading courses, however, have been based not upon letters or syllables but more upon the "Look and Say" method of whole words, dealing later with specific problems of letter differentiation. To begin with, words need to be related to the objects they represent and the video screen can bridge the gap between objects or non-verbal concepts and the symbolism of the printed word. This technique was seen as a possibility by Chovil in the BBC series **Look and Read**. Each programme contained an episode from a continuing serial and most of the significant words were superimposed on the screen as they occurred in the action. Thus the audience could see the word with its visual equivalent. Afterwards the words were shown first on their own and then with a still picture reminding the viewer of their context. This is a fairly complex activity (in that it includes filmed sequences of live action with accompanying sound) but current developments in computer graphics or in the interfacing of computer and, say, videodisc no longer restrict the technique to television alone. Moreover, other techniques are just as relevant. Among those described by Sherrington above is an exercise which requires the learner to choose, from a selection, the correct word for a particular picture or the correct picture for a given word. More elaborate but still widely applicable techniques involve the substitution of words for pictures. A word is shown at the top of the screen and again at the bottom but this time in conjunction with others of similar graphic representation. In giving the correct answer, the word should be supplemented with a picture of the normal object to confirm meaning and to re-inforce the learner's correct identification of the word shape.

Occasionally, certain words cause problems of recognition (omission as in pilot/plot; reversal as in dog/god; substitution as in wish/wash). Again, animation and captioning making full use of colour and movement can group words together and highlight such features. Animation on the screen, though expensive, is one of the most advantageous of the graphic features of the medium for reading purposes. Gattegno's reading scheme was based entirely on it and from the above it will be evident that its use to highlight graphic features, synthesising and breaking them down, categorising, grouping them and demonstrating normally non-graphic features, is a valuable asset. In addition, it is a technique which appears to be favoured by young viewers. Porter (19) draws attention to the fact that animation was a feature of all the visual sequences in her experiments to which children paid most attention. It is fortunate, therefore, that it is also a technique which unlike some of the others mentioned, can be used (albeit with differing degrees of sophistication) in a number of the new electronic media-including computers.

Sound and the phonic approach to reading

Another characteristic of the new media is sound and though its presence has been recognised above, its utilisation has not been explored. While it must be admitted that few electronic forms of audio-visual communication can rival television (or video tape and disc) in sound quality, it is unlikely that this will remain a fact. Voice synthesis may still be crude but it is developing and the absence or low quality of sound in these media is changing rapidly. It is thus not beyond the capabilities of at least some of the new media to present phonic assistance in reading. Several television series – notably **Look and Read** and those produced by the Children's Television Workshop – have already initiated this approach by incorporating morphophone sequences in programmes while both Gattegno and Sherrington propose ways of developing this aspect of reading tuition, which we may now extend beyond television.

In the early stages of this type of practice a symbol to sound or one to one relationship is considered. Gattegno's whole scheme is based on the premise that "On the screen it is possible to animate designs that can be associated with specific sounds" (20) and begins with the presentation of signs to each of which one sound corresponds. Sherrington (21) suggests that as a word is spoken, the written form should appear on the screen and the sound symbol being practised highlighted. He goes on to suggest that several words using the same sound and symbol may appear on the screen until eventually the sound symbol is shown in a medial and final as well as initial position in the word. The words would normally appear in context and might be illustrated by pictures – the words being superimposed upon the picture to one side of the screen and appearing one by one. The same technique could be used then for symbols representing more than one sound, or sounds represented by more than one symbol. Other features which can be handled similarly, are items like prefixes, suffixes, inflectional endings, the silent 'e' and unexploded plosives. Following on the contextualisation of such features, they may be recapitulated individually or together to highlight salient features with the symbol underlined and the word repeated in the sound channel. The material may then be tested by the presentation of multiple spellings and the sound repeated after which all but the correct spelling dissolve followed by a confirming picture and a re-inforcing repetition of the pronunciation. At a later stage the learner might be asked to say the sound emphasised in a list of words, or he may be asked to say whether the sounds are the same or different. Another exercise might present a number of pictures, each demonstrating a superimposed word, and the learner selecting the word with the dissimilar emphasised sound.

In combination, sound and graphics form a powerful reading aid. By means of animation and colour, for example, a particular sound can be isolated and identified. Words can be made to split apart, to demonstrate phonic relationships, and then to rejoin to show how sounds and symbols combine to make spoken and written words. Thus sound and a highly manipulable screen combine to enhance the reading process.

Fluent reading activities on the video screen

As reading progresses, the medium's ability to manipulate graphic features moves from individual and small clusters of symbols to larger sequences of connected words, phrases and sentences. A typical passage, like those in **Look and Read** for reading directly from the screen, consists of about 65 words on a black background and uncovered slowly from left to right. At this point, young readers may be transferred completely to the printed page. Yet there are a number of reasons why this should not be to the total exclusion and neglect of the electronic page. The video screen provides far-point reading activities – a desirable end in itself for young pupils who are commonly more efficient visually at a distance because of their natural tendency to far sightedness. Future generations of pupils will also need increasing practice and experience in handling the pages of electronic text as media in their own right. In using the new media, they will need to make use of further reading skills which, in any case, these media are able to demonstrate and exercise most efficiently themselves.

Once the reader has mastered particular structural features of the language and knows their meaning when he reads them, it will not be necessary to linger over every word, fixating on only the more important words rather than prepositions, articles, conjunctions, verbal auxiliaries etc. The rapid presentation of many phrase, clause and sentence structures of the same type on the screen will encourage this reading redundancy. It will encourage the reader's eyes to fixate on the new item in each group while his peripheral vision assimilates the rest of the structure. Perhaps beginning with verb and prepositional phrases, graded exercises could progress to simple noun phrases, short relative clauses and so on. Later, short connected prose might be presented in a series of timed exposures making use of a third dimension to these apparently two dimensional displays – time. This can be extended into a course of speed reading as one of the ultimate skills; and one which is necessary given the nature of much of the text appearing at producer rather than reader rate on the video screen.

Studies of good readers (22) have shown that they tend to have more regular eye movements, shorter fixations, wider eye-span and fewer regressions than other readers. Speed reading programs should develop these characteristics and since the electronic media are in many ways suited to such reading programmes they will be admirable for correcting many of the faults of the slow and

inefficient reader. The tachistoscope and pacer are two of the early machines utilised in speed reading programmes and both may be replicated by the video screen. The tachistoscope projects whole groups of words onto a screen for a preset time. The whole word group is perceived at one fixation and by reducing the time gap between each exposure the intention is to reduce the length of time between each fixation during reading. Such brief projections are a simple matter for the electronic screen. Pacers are mechanical devices which move a shutter over a page of print at a preset speed thus eliminating re-reading and regressions in the movement of the eyes. Again, the new media can produce a similar effect by scrolling a column of print from the bottom to the top of the screen at the speed required or by blacking selected sections of the text.

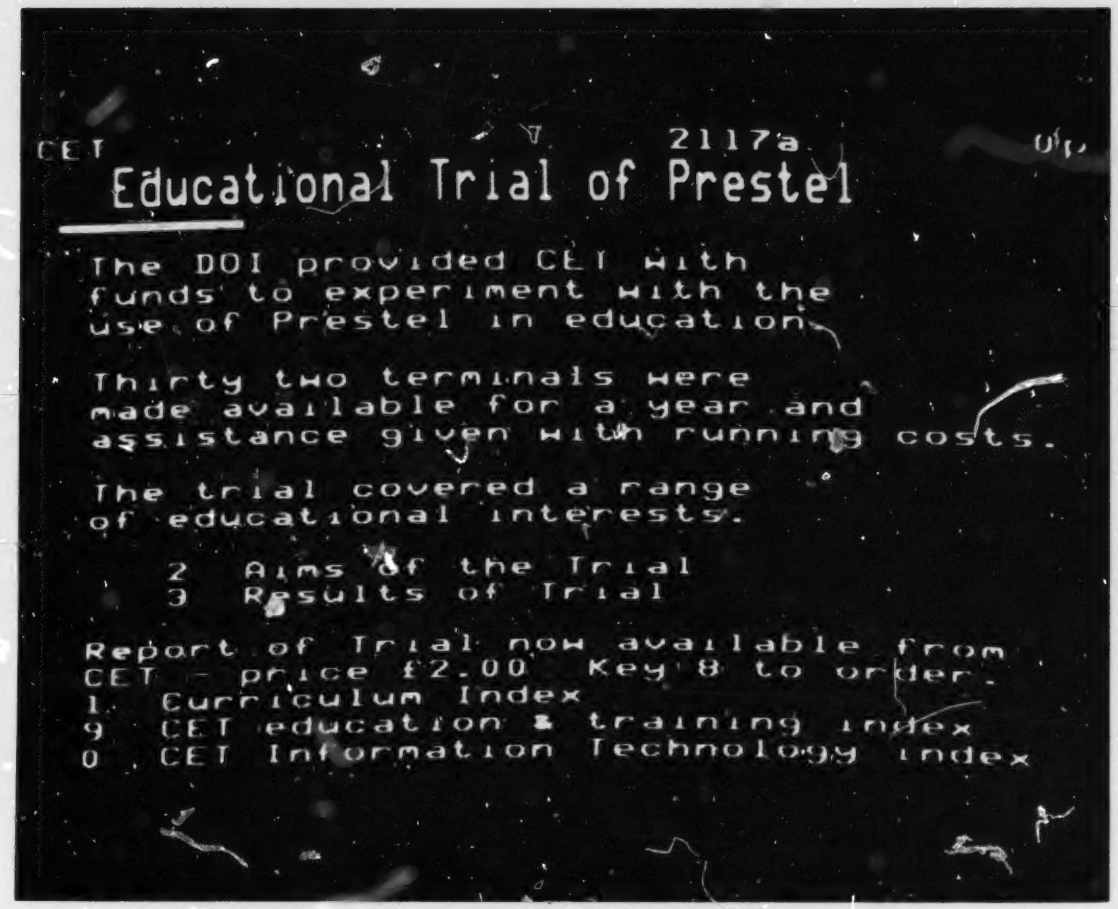
Higher skills demanded by the new media

It must be remembered that speed reading is not the only form of higher reading skill. The efficient reader is not one who is necessarily only a skilled speed reader but one who can also adopt a style of reading or strategy to suit the material, circumstances and his objectives in reading. In the past it might have been said that the electronic medium most widely available – television – presented only a very limited amount of *continuous* text and that of little linguistic diversity. Even Sherrington admitted that the medium could not"... possibly provide the quantity of written material which a learner will require" (23). The medium could also be criticised for inducing only speed reading – pacing being determined by the producer not the reader with the rate of display being rapid in the interests of economy or sheer slick presentation. Such criticisms, however, are becoming increasingly irrelevant to the new technology. An existing frame of teletext or viewdata can carry 24 lines each of 40 characters (see Figs. 1 and 2) but Fedida and Malik, pioneers of viewdata, expect that "... the immediate limitation arising from the existing screen technology ... will eventually change as the receivers are expanded to eighty characters a line, which is likely to happen in the mid-eighties" (24). Meanwhile 80 column video display units are already fairly commonly in use with micro-processors (see Fig. 3). In terms of the number of frames available, much has already been indicated about the storage capacity of Prestel, and (to a lesser extent) teletext. Videodisc units, either alone or interfaced with a computer also increase the quantity of electronic print on which the reader can exercise his skill – or rather skills since the quantity of text now available increases the diversity of textual modes possible. The interactivity of the media permits the differing reading strategies which these textual types demand. Regression, re-reading, skimming and scanning were all limited or impossible before interactive technology. Now, given that there are still some constraints like the speed of access to teletext or, to a lesser extent, the accessing of data files on computer, the reader is far more able to turn screenfuls of print at will, employing different strategies as the plethora of texts demands; and how better to teach the skills which enable him to make optimum use of the new technology than via those new media themselves?

The interactive nature of the new media not only allows (and in commercial use demands) the exercise of a greater number of reading and retrieval strategies, it also permits the reader to learn at his own rate. In transmitting text to a mass audience via traditional one way broadcast channels of communication it was impossible to proceed at any other than one rate and that rate would tend towards a norm or rather the lowest common denominator. This is, of course, a problem in the teaching of any skill other than on an individual basis. The problem is more acute in the teaching of reading, where there is a clear linear progression with ascending order of difficulty, and where the element of time is itself an important factor in the utilisation and development of the higher reading skills.

Gagné took the interactive argument further, criticising the television medium not simply for its lack of regulatory feedback but also because it failed to involve the learner in an active way:

> "... a television programme can introduce and guide the learning. But again ... the learner must have a chance to apply the skill." (25)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Educational Trial of Prestel
The DOI provided CET with funds to experiment with the use of Prestel in education.
Thirty two terminals were made available for a year and assistance given with running costs.
The trial covered a range of educational interests.
2 Aims of the Trial
3 Results of Trial
Report of Trial now available from CET - price £2.00 Key 8 to order.
1 Curriculum Index
9 CET education & training index
0 CET Information Technology index

Fig. 1. **Viewdata.** A typical Prestel frame of text occupies 24 lines, each of which is able to carry 40 characters. It uses both upper and lower case and it will be noted that larger letter sizes are available.

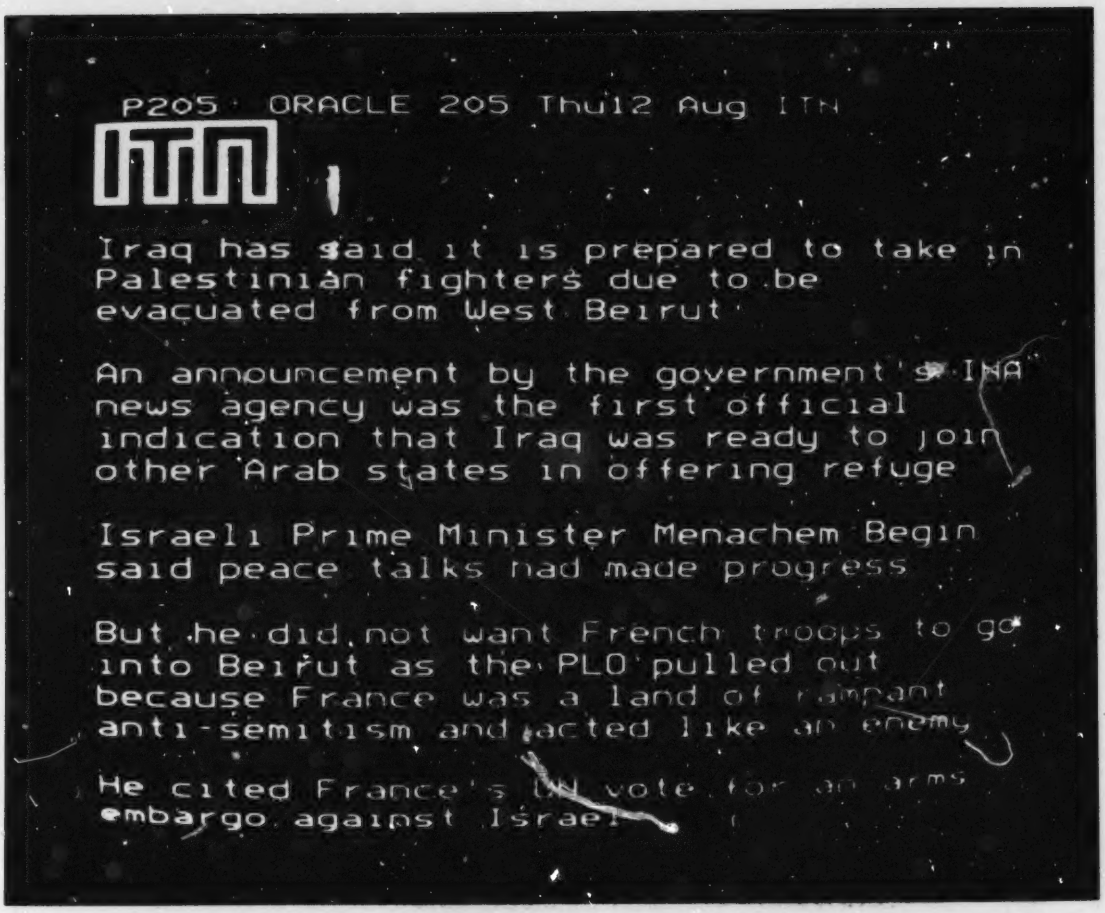
P205 ORACLE 205 Thu12 Aug ITN
Iraq has said it is prepared to take in Palestinian fighters due to be evacuated from West Beirut
An announcement by the government's INA news agency was the first official indication that Iraq was ready to join other Arab states in offering refuge
Israeli Prime Minister Menachem Begin said peace talks had made progress
But he did not want French troops to go into Beirut as the PLO pulled out because France was a land of rampant anti-semitism and acted like an enemy
He cited France's UN vote for an arms embargo against Israel

Fig. 2. **Teletext.** Like Viewdata, both the BBC's Ceefax and ITV's Oracle teletext services display frames consisting of 24 lines, each with a maximum of 40 characters. The font style is not confined to the teletext medium. It has been adopted by some micro-computers. More recently, it has been offered as an *alternative* textual display mode on the new range of micro-computers (e.g. BBC Acorn).

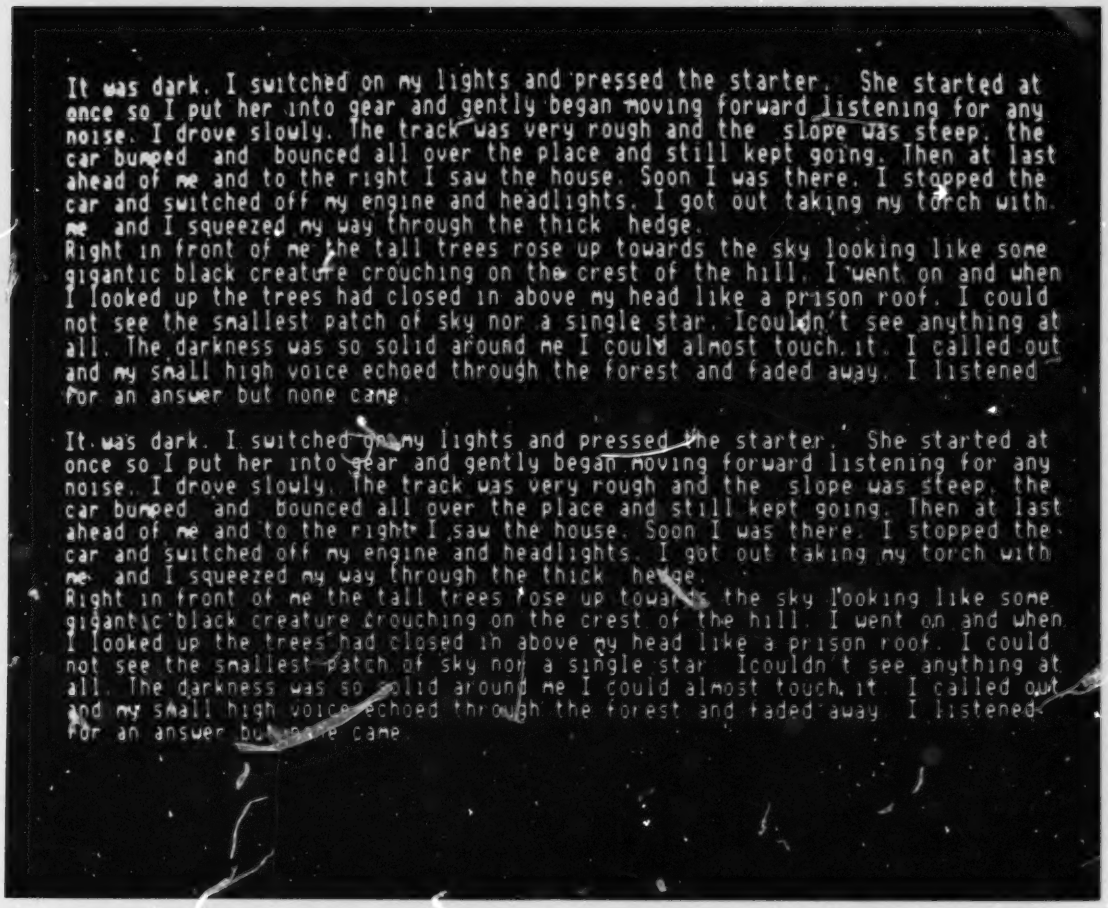
It was dark. I switched on my lights and pressed the starter. She started at once so I put her into gear and gently began moving forward listening for any noise. I drove slowly. The track was very rough and the slope was steep. the car bumped and bounced all over the place and still kept going. Then at last ahead of me and to the right I saw the house. Soon I was there. I stopped the car and switched off my engine and headlights. I got out taking my torch with me and I squeezed my way through the thick hedge.
Right in front of me the tall trees rose up towards the sky looking like some gigantic black creature crouching on the crest of the hill. I went on and when I looked up the trees had closed in above my head like a prison roof. I could not see the smallest patch of sky nor a single star. Icouldn't see anything at all. The darkness was so solid around me I could almost touch it. I called out and my small high voice echoed through the forest and faded away. I listened for an answer but none came.
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Fig. 3. **An 80 column video display.** These are becoming increasingly common as screen resolution and computer graphics improve. The above text is reproduced from a display on the BBC Acorn computer. Such modern models often give the option of 20, 40 or 80 column display modes.

Again, such criticisms are less relevant to the new media. It has already been stated that sufficient quantities of electronic print are now possible. So too, is the ability to call upon it and regulate it at will. Jones (26) reports an experiment in teletext where pupils particularly enjoyed the 'interactive' feature of using the reveal button which brought up the answers on the screen. This provided an element of immediate feedback and reinforcement. Videodisc and the computer can incorporate more individualised programmed learning and self-regulated reading experiences together with more active methods of fostering reading skills. Such activities as group prediction, cloze procedure and sequencing are all pupil-orientated tasks introduced by the teacher so that readers will engage more actively with the text. Now they can be applied to the electronic media and built into interactive programs. The present writer has devised his own series of computer programs and data files of text embodying these activities. They seem to work successfully and certainly appear to help readers handle electronic print – even if the transfer of reading skills to conventional print is more difficult to ascertain.

The idiosyncracies of video text

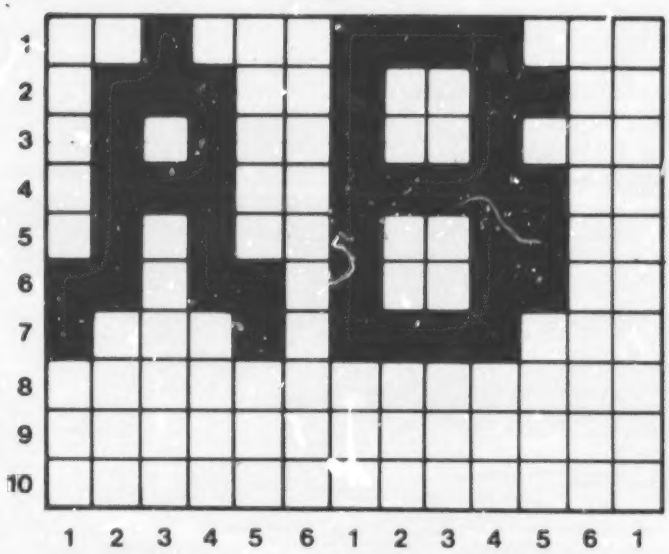
Most of what has been written above is concerned with reading skills which are valid and applicable to both print and the video screen. The argument has been that the video screen is ideally suited to the development of certain reading sub skills especially at the graphic level – skills which in any case need to be exercised on video text if the reading teacher is to fulfil his obligations to his pupils. But it would be wrong to assume that there is any complete transfer of skills between page and screen. Each is, of course, a different medium and so the process of communication must be dissimilar. There may be similarities in the reading processes involved in each, but there are also important differences. While it is unlikely that teachers will neglect to assist their pupils in coping with the conventions and peculiarities of the printed medium, it is more likely that they will assume the process of reading from the video screen to be like that from the page and so fail to consider and prepare for the unique demands it makes or, even worse, neglect the medium completely.

The reader of the video screen is however immediately faced by constraints which are less or even non applicable to the printed page. The viewing angle of the screen is critical (not less than thirty degrees) as is distance (not less than three nor more than twelve times the width of the screen). His problems of perception are not helped by the fact that unlike other print, his text is back-lit and is easily obscured by direct or bright ambient light. Even given good viewing conditions he may still be faced with problems of legibility in the material which appears on the screen before him.

Harrison and Braverman in an overview of the subject (27) reveal that there are two categories of factors relevant to the legibility of video text: a) factors dealing with the characteristics of the printed material itself – typeface, size of type, leading, stroke width, length of line; and b) factors dealing with the characteristics of the background – colour, brightness, resolution and contrast. Briefly their main conclusions were these: in general, black on white characters appear to be the most legible, though high contrast between the two should be avoided. A related factor now that colour is available is that of chromaticity and achromaticity and they presented a table ranging from blue on grey as one of the most legible colour combinations to red on green as one of the most illegible.

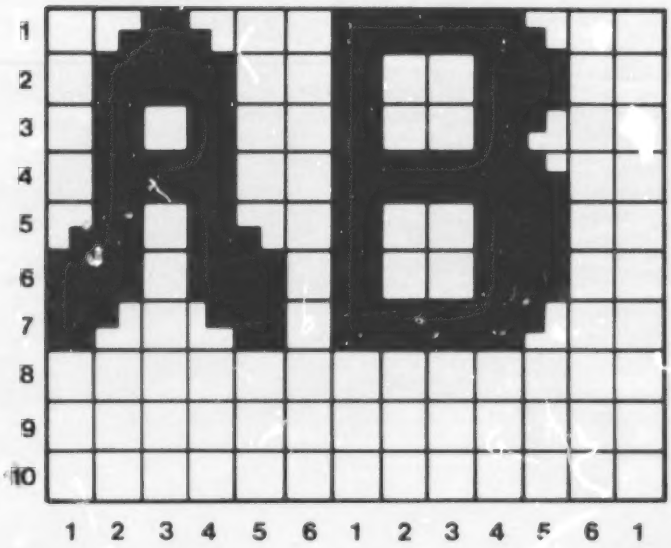
They also reported the work of Tinker (28) who claimed that lower case type is read more quickly and more efficiently because it gives the reader more clues with a more pronounced and well-defined letter/word shape than upper case. At the same time upper case type has the advantage of being seen more easily from a distance. They say several studies have looked at type style in broadcast print. Kinney (29) investigated Modified Idealised Hazeltine fonts constructed of television lines digitally controlled to generate symbols in a 5 x 7 matrix (see Fig. 4) and recommended them for use. Klare, Nichols and Schaford (30) found no advantage of square span and spaced unit style over Leroy conventional composition. Vartabedian (31) found that on average, 7 x 9 dot matrix symbols were identified 10% faster with 50% fewer errors than stroke drawn symbols. Some alphanumeric symbols are frequently confused (for example Z and 2, B and 8, G and 6). To minimize confusion errors a number of researchers including McVey (32) have recommended the use of Lincoln/Mitre symbols. Other styles that have been recommended are Leroy and Artype No 1158 Futura Medium.

a



5 x 7 Dot matrix for alphabetic characters

b



5 x 7 Dot matrix with character rounding

Fig. 4. These **character dot matrices** illustrate the visual composition of single characters on a video screen. Recent models of microcomputer (e.g. Sinclair Spectrum, BBC Acorn) allow the programmer to redefine individual letters or the whole character set. This may be of particular use for early readers where a change of font from printed book to video screen might prove a disadvantage.

Another important consideration in the legibility of print is the concept of aspect ratio. Vartabedian (33) recommended a maximum width to height ratio of 3:4 while Botha and Shurtleff (34) recommended the ratio of the widths of inactive to active elements should be no greater than 1:1.

Spacing is also critical in creating legibility. If spacing is too large, eye movement is not efficient. If it is too narrow, it causes eye fatigue. Harrison and Braverman (35) recommend that spacing between lines should be ½ – 1 times the height of the symbols and that between letters it should be ½ symbol width with ½ – 1 symbol widths between words and 2 – 3 symbol widths between sentences.

Finally, in terms of size, Millerson (36) recommended that for good legibility, minimum lettering size should be 1/10 – 1/25 picture height while Shurtleff (37) postulated that the minimal acceptable vertical symbol resolution should be 10 lines per symbol height.

Legibility is not a simple concept and such recommendations as those above (which are only a small selection from those available) cannot be considered definitive. Size, spacing, type font, contrast of background, chromaticity all interact with reader preference and past experience and familiarity to produce a legibility continuum. Several factors, each of which alone has only a slight influence on relative legibility can, in combination, produce significantly lower legibility. Moreover, there are constraints imposed by the hardware in use. For example, the system of teletext adopted for Oracle in Great Britain uses Aston teletext editing equipment with a PDP 11 minicomputer and software by DEC allows for 24 rows of computer generated specific print with 40 characters per row in one of 7 colours (see Fig. 5). Emphasis can be added by the use of double height or flashing characters and the resulting text may be inset on a black or coloured background. It can provide only rather crude 'graphic' letters and diagrams formed from a mosaic or matrix and certainly there is evidence that below average readers are "... somewhat daunted by the uniform, solid blocks of text and by the unfamiliar computer forms of certain letters." (38) Teletext would appear then to be limited in terms of legibility – particularly when the alpha-mosaic British system is compared with the alpha-geometric Canadian system. The latter can cope with much more elaborate and well defined shapes and symbols for it uses a system borrowed from computer graphics whereby the basic geometrical shapes are coded into numbers rather than built up in a dot-patterned matrix. Even so, research has been conducted on the legibility of such a system and an interim research report from Southampton University (39) now outlines recommendations for those preparing teletext on the system (albeit specifically for those preparing subtitles for hearing-impaired viewers). It recommends the use of white double height mixed case characters against a black background; single spacing between words with an additional space before exclamation marks and question marks and after other punctuation marks; left justification of text; use of coloured type (rather than background) or upper case for high-lighting or emphasis. It discusses line-breaks in conjunction with sentence structure and suggests certain syntactically sensible points, discouraging enjambment of words. Of the 49 possible colour combinations it rejects certain pairings as illegible (for example: magenta on red, cyan on green, white on yellow) and says of the remainder that the most acceptable combinations appear to be blue on white; red on white; white, yellow, cyan or green on black, blue on cyan or yellow; red on yellow; blue on green; yellow on red; white on red and yellow on blue.

Such recommendations have wide significance and even those concerned specifically with subtitling on broadcast television may also have relevance elsewhere. In situations where the viewing reader still has no control over the pacing of video text, the report's recommendation that each full line of text requires at least three seconds of display time (or roughly one second for every two words) is of valuable use.

The teacher's responsibility

The I.B.A. Research Fellowship at Southampton University is a good example of the involvement of a psycholinguist in the new electronic print media. It is important that teachers and others concerned with reading skills also become involved in the new technology for these media may have much to offer – even if we still have much to learn. The purpose of this paper has been simply to outline some of those aspects of the electronic media which the present writer feels

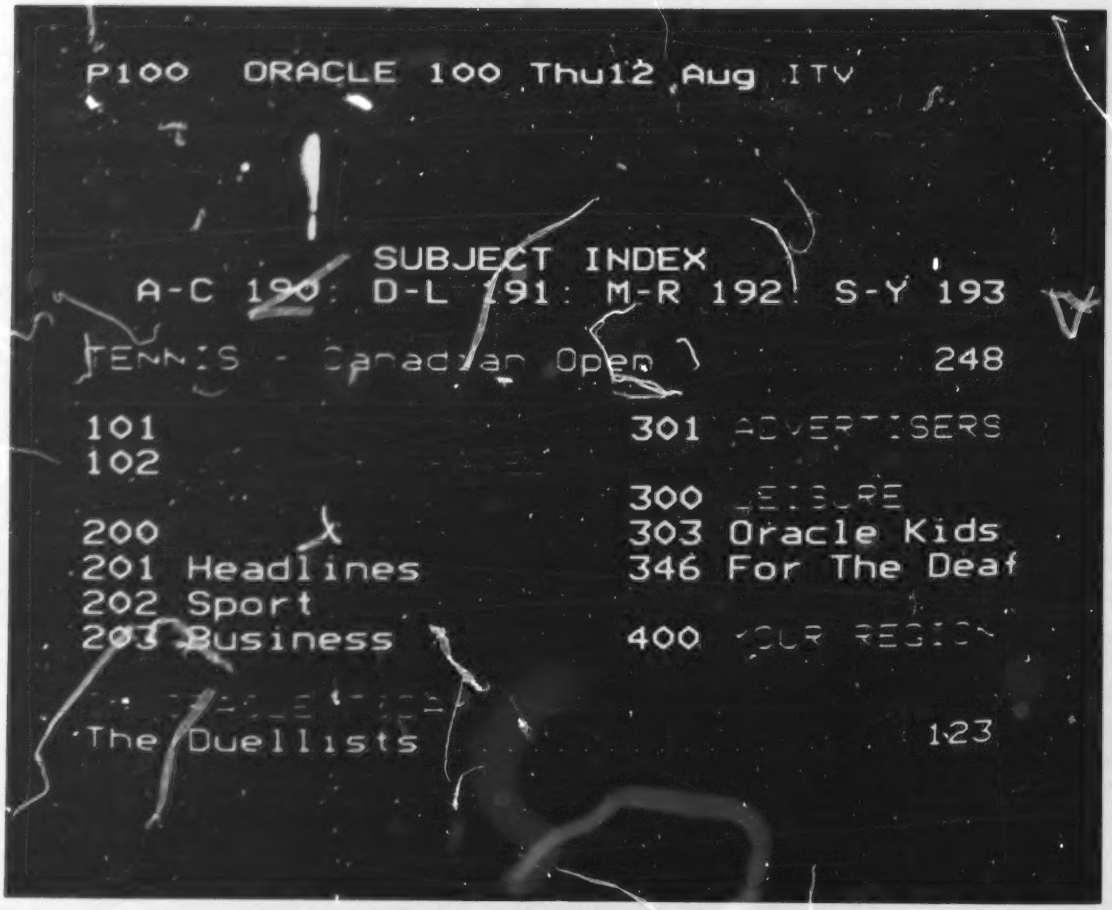


Fig. 5. **Teletext.** The above page of Oracle, the ITV teletext service, demonstrates not only the larger character set but also that, as an information retrieval system, it demands referencing skills.

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should receive the attention of those involved in teaching or investigating the reading process. We need to consider the opportunities afforded by the media in terms of fostering both conventional reading skills and those which may – or may not – be particular to the electronic page.

It is not a subject which should be ignored. Even if teachers fail to investigate applications to benefit existing reading programmes, they must not fail to consider the future. Literacy involves all the print media – including the electronic. Full literacy in the twenty first century will probably demand fluency in them all. Teachers must equip their pupils with the skills to read them all – whether these skills are common or medium specific. They must, moreover, give pupils the opportunity for exercising those skills and in so doing, they will have a role to play in both the development of electronic print for teaching purposes and (hopefully) in the design of those materials and software which the reader will encounter increasingly in his adult life.

> Today is the time to realise that the reading professional has the opportunity, the responsibility and the power to shape the skills of the reader of electronic print and to ensure that valuable material will be available for that reader/viewer in the future. (40)

Far from discouraging the reading habit, the electronic media demand its use and in so doing they offer the modern teacher new tools to use in his role as a teacher of reading. They may also make new demands and new objectives. In what ways and to what extent the skills of reading in this context can or will be demanded and developed is an enquiry that for educationalists is only just beginning.

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